(1) Translating Calculus Ideas to Parametric Curves

Suppose you are given a curve defined as $x(t)$ and $y(t)$:

(a) $\frac{dy}{dx}$

(b) $\frac{d^2y}{dx^2}$

(c) area under curve

(d) arc length

(2) Given the parametric equations $x(t) = t^3 + 1$, $y(t) = 2t - t^2$, answer the following questions without eliminating the parameter.

(a) Find dy/dx and d^2y/dx^2.

(b) Write the equation of the tangent line to the curve at $t = 1$.

(c) Is the curve concave up or concave down at $t = 1$?

(d) Determine the area below the curve and above the x-axis.

(3) Determine the arc length of the cycloid $x(\theta) = \theta - \sin(\theta)$ and $y(\theta) = 1 - \cos(\theta)$ from $t = 0$ to $t = 2\pi$.